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UNITED STATES
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INSPECTION STANDARDS FOR STRIP MINES
(COAL AND LIGNITE)

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INFORMATION CIRCULAR

UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

INSPECTION STANDARDS FOR STRIP MINES (COAL AND LIGNITE) 1/

Revised October 1945

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INTRODUCTION

This inspection standards have been prepared for use in the Federal inspection of strip mines producing bituminous coal, anthracite, and lignite. This circular is a revision of the Safety Code for Strip Mining, which was prepared by the Bureau of Mines and employed as a guide for Federal inspectors. Numerous changes have been made in the original code to keep the standards in step with improvements in the industry. With continuing changes in mining methods and facilities some of these standards may become inapplicable, and further revision may be advisable. Therefore, questions regarding these standards and suggestions regarding new standards should be brought to the attention of the Bureau of Mines.

Few States have laws pertaining to strip mines, but where such laws do exist, it is possible that some of the standards may conflict with them. In cases of conflict, the intent is not to advocate noncompliance with State laws, but to suggest reconsideration of such laws or safety orders.

Although an effort has been made to word these standards so they may be understood readily, a reasonable interpretation should be placed upon them. In some of the standards the words "reasonable," "suitable," or "properly" are used in recognition of the need for reason and sound judgment in safety work.

1. SURFACE STRUCTURESTipple and Cleaning Plant1.01. To minimize fire and coal-dust-explosion hazards:

- a. Electric motors, switches, and controls used in tipples and cleaning plants should be of dusttight construction.
- b. Stoves or other heating devices should be properly and safely installed and of a type to meet these purposes.

- c. Coal dust should be thoroughly cleaned from the tipple frequently, and, if possible, daily. If it is impracticable to remove dust from remote places, such places should be rock-dusted.
- d. Coal dust should be allayed with water or other wetting agent at points where large quantities of dust are released, or a dust-collecting system should be installed at such points.
- e. Coal dust should be kept from accumulating in or about any surface building.

1.02. Welding in tipples or cleaning plants should be done preferably when the plant is idle; welding should not be done in a dusty atmosphere; a fire extinguisher should be readily available; and combustible surroundings should be wetted down before and after welding.

1.03. Where coal is treated with oil, men exposed to the oil mist should wear permissible respirators, affording protection against fume or mist, and sources of ignition should be kept at safe distances from the oil spray.

Steam and Compressor Plants

1.04. All boilers should receive at least one internal inspection annually by an authorized inspector, and a written record of such inspection should be kept.

1.05. A safety-valve escape should not discharge lower than 7 feet off the floor; preferably, the discharge should be piped to the outside of the building.

1.06. At least two safe means of exit from the boiler room should be available, and any doors should open outward.

1.07. A stairway or fixed ladder should be provided to give easy access to the top of boilers or runways between boilers.

1.08. Compressed-air receivers should be equipped with safety or relief valves.

1.09. Compressed-air receivers should be inspected at least annually by a competent person, and a written record of such inspection should be kept.

1.10. Gages should be provided for boilers and compressors (steam pressure, air pressure, water, etc.)

Wash House

1.11. Where wash houses are provided, they should be:

- a. Provided with showers and an adequate supply of hot and cold water.
- b. Kept clean and sanitary.

- c. Provided with at least two exits.
- d. Well-illuminated.
- e. Provided with clothes lockers or hangers.
- f. Kept well-heated and, if necessary, heating equipment guarded against contact hazard.
- g. Properly ventilated.
- h. Provided with adequate facilities to prevent the spread of foot infection. If foot baths are used, the disinfectant should be changed daily.
- i. Provided with sanitary toilet facilities.

Supply House

- 1.12. Material should be stored so that it will not fall or cause a stumbling hazard.
- 1.13. Oil, grease, and similar flammable materials should be stored in closed containers separate from other materials and in such a manner as not to create a fire hazard to nearby buildings or mine.
- 1.14. If oil and grease are stored in a building, the building should be of fire-resistant material and provided with a ventilator extending to near the floor level.
- 1.15. Not over 5 gallons of gasoline should be stored in a warehouse. The containers should be painted a conspicuous color, preferably red, and marked "Gasoline." The containers should be provided with tight covers for the spout and the can.

Stairways, Ladders, Toeboards, and Railings

- 1.16. Surface stairways should not be set on an angle of more than 45° with the horizontal.
- 1.17. Stairways should be provided with safe handrails and kept in good repair.
- 1.18. The treads of stairways should present minimum slipping hazard, and be of uniform construction and spacing.
- 1.19. Clearance over stairways should be at least $6\frac{1}{2}$ feet; where such clearance is not feasible, a conspicuous warning sign should be displayed.
- 1.20. Permanent ladders should be provided with guards, if necessary.
- 1.21. Platforms, elevated walkways, and openings in floors should be provided with toeboards and railings.

Housekeeping, Illumination, and Heating

- 1.22. Good housekeeping should be practiced. In addition to orderliness in storing materials and cleanliness of buildings, good housekeeping

includes the removal of possible sources of injury, such as protruding nails and broken glass.

- 1.23. Surface buildings should be well lighted and heated, if necessary.

2. MISCELLANEOUS SURFACE CONDITIONS

Mine-Refuse Disposal

- 2.01. Mine waste should be so stored as to minimize fire, fume, or slide hazards.
- 2.02. Waste dumps should be fenced where there is a hazard to persons, especially children.
- 2.03. Persons should not be permitted to live or work in buildings imminently endangered by fire, fume, or slide hazards from waste dumps.
- 2.04. If workers on waste dumps may be exposed to serious fume hazards, permissible universal gas masks should be immediately available.

Yards and Storage of Material

- 2.05. Lumber, ties, and all materials, including rails, scrap iron, and other scrap, should be properly stored and piled so that they will not obstruct roadways, present stumbling hazards, and will not roll or fall.
- 2.06. Roads, paths, and walks should be kept free from obstructions and should be well-illuminated if used by night shifts.

Fire Prevention

- 2.07. As far as practicable, all buildings should be constructed of fireproof or fire-resistant material. Where this is not feasible, the combustible material should be reduced to a minimum.
- 2.08. Adequate fire-fighting equipment should be provided. This equipment (suited to the size and type of surface plant), such as hydrants, hose and nozzles, chemical trucks, fire extinguishers, and barrels filled with water, should be readily accessible and its location marked plainly.
- 2.09. If municipal fire-department facilities are available, fire-hydrant couplings should be standard and interchangeable with those of municipal fire departments, or suitable adapters should be provided.
- 2.10. Fire-fighting equipment should be inspected and tested at least every 6 months and a record made of such inspections.

- 2.11. A fire-fighting organization should be maintained and, if feasible, fire drills held at least twice a year.
- 2.12. Tight metal receptacles should be provided for oily waste.
- 2.13. Smoking in and about surface structures should be restricted to places where it will not create a fire or explosion hazard.
- 2.14. Highly flammable liquids, such as gasoline and naphtha, should never be used for cleaning machine parts.
- 2.15. A recognized safe cleaning solvent should be used for cleaning machine parts.

3. MINING METHODS, CONDITIONS, AND EQUIPMENT

Stripping and Drilling Overburden

- 3.01. While stripping, the highwall bank should be sloped as much as possible and all loose material removed to prevent slides. Overhanging ledges should not be permitted. Pits should be adequate in width and kept well-drained.
- 3.02. When box cuts are made in thick cover, the spoil should be moved back from the face of the cut to prevent material from rolling back onto workmen in the pit.
- 3.03. Workmen in the pit should keep constantly on the alert for slides, rock, or dirt falling from the face of the highwall and the spoil banks, especially during intermittent freezing and thawing weather.
- 3.04. Where stripping has been done through public roads, "danger" signs should be posted, or barricades should be erected at proper locations to warn and protect the traveling public.
- 3.05. Runways should be provided on the highwall at suitable intervals for the safety and convenience of workmen whose duties require them to enter and leave the pits frequently.
- 3.06. Where horizontal auger drills are used in the pit in connection with blasting of overburden, the operator should not leave the controls while the drill is in operation, and the controls should be so located that they can be reached from one position.
- 3.07. Employees should be required to keep in the clear of the auger or drill stem while they are in motion and should not be permitted to pass under or step over a moving drill stem or auger.
- 3.08. Where horizontal holes are drilled in the highwall, drill crews should make a careful inspection of the face of the highwall before drilling operations begin, and all loose boulders and material should be removed.

- 3.09. Where churn drills or vertical rotary drills are used for drilling overburden, the drillers should not work under suspended tools. When collaring holes, inspecting, or during any operation where tools are removed from the hole, the tools should be lowered to the platform.
- 3.10. Vertical holes should be protected by covering them or leaving at least 1 foot of casing above the ground level.
- 3.11. When a churn or vertical rotary drill is in operation, the driller or his helper should be at the controls.
- 3.12. Drilling equipment should be maintained in safe condition.

4. EXPLOSIVES, DETONATORS, AND BLASTING

Explosives and Detonator Magazines

- 4.01. Separate magazines of proper construction should be provided for the storage of explosives and detonators.

NOTE: Permanent magazines for explosives and detonators should be of a building type, an igloo or army type, a portable type, or a tunnel or dugout type.

Walls of building-type magazines should be substantially constructed and should meet the following standards or be constructed of other material in a manner which will make them at least equally substantial:

(a) Solid construction, not less than 6 inches in thickness, of materials such as concrete, masonry, medium soft brick, or wood; or

(b) Filled construction, such as concrete blocks with the cells filled with screened sand, weak concrete, cement mortar, or other effective bullet-resistant filler; or exterior and interior wooden walls not less than 6 inches apart with the space between filled with screened sand, weak concrete, cement mortar, or other effective bullet-resistant filler, and the exterior walls covered with sheet iron not lighter than No. 26 gage, or other fire-resistant material; or

(c) Lined construction, such as steel plate not lighter than No. 14 gage, lined with weak concrete, cement mortar, brick, or screened sand not less than 6 inches in thickness, or with hardwood not less than 2 inches in thickness, or with softwood not less than 3 inches in thickness.

The same standards should govern the construction of any artificial enclosing wall for tunnel- or dugout-type magazines on or exposed to the surface of the ground.

Foundations of building-type magazines should be substantially constructed, and any space between the floor and the ground should be enclosed in such a manner as to prevent the entrance of persons, animals, sparks, and firebrands.

Roofs of building-type magazines should be fire-resistant and substantially constructed to resist theft, as for example, by 3/4-inch sheathing covered with sheet iron or slate. Roofs not constructed of fireproof material should be covered with sheet iron not lighter than No. 26 gage or other fire-resistant material. The roofs of high-explosives magazines so located that it is possible to fire bullets directly through the roof into the explosives should be made bullet-resistant by material of construction, or by a ceiling that forms a tray containing not less than a 4-inch thickness of sand or other equally effective bullet-resistant filler erected in the interior of the magazine, or by other methods.

Doors of magazines on or exposed to the surface of the ground should be constructed of 3/8-inch steel plate lined with a 2-inch thickness of wood; or of a thinner steel plate with a greater thickness of wood, at the rate of 1 additional inch of wood for each 1/8-inch decrease in the thickness of the steel plate; or of wooden walls at least 4 inches apart and filled with screened sand or other effective bullet-resistant filler, the exterior being covered with sheet iron not lighter than No. 26 gage, or other fire-resistant material; or of wood not less than 6 inches in thickness; or of reinforced concrete not less than 4 inches in thickness.

Doors of all permanent magazines should be equipped with two mortise locks; or with two padlocks fastened in separate hasps and staples; or with a combination of a mortise lock and a padlock; or with a mortise lock that requires two keys to open; or with a three-point lock. Padlocks and mortise locks should be the equivalent of five-tumbler jarproof locks. Doors should be provided with strong hinges, hasps, and staples attached by welds, rivets, or bolts fitted with lock washers and nuts on the inside of the magazine and installed in such a manner that the fastening cannot be removed when the magazine is locked.

Magazines should have no openings except for entrance and ventilation. Foundation vents should be of an offset-type construction, and all vents should be effectively protected with metal screening or otherwise constructed to prevent the entrance of persons, animals, sparks, or firebrands or the direct penetration of bullets that can detonate the explosives.

Box-type magazines and operation magazines should be strongly constructed of 2-inch hardwood or of 3-inch softwood or other equally theft-resistant material. Any metal magazine should be lined with a nonsparking material. Doors or lids should be provided with strong

hinges, hasps, and staples attached by welds, rivets, or bolts fitted with lock washers and nuts on the interior of the magazine and installed in such a manner that the fastening cannot be removed when the magazine is locked. Box-type magazines should be equipped with at least one lock equivalent to a five-tumbler jarproof lock.

Box-type magazines, when located outside a building, should be securely anchored. No magazine should be placed in a building containing oil, grease, gasoline, waste paper, or other highly flammable materials nor should a magazine be placed less than 20 feet from a stove or furnace or open fire or flame, or less than 5 feet from other sources of external heat.

- 4.02. a. High explosives (permissible explosives and dynamite), in amounts exceeding 125 pounds, should be stored in permanent magazines which are theft-resistant, fire-resistant, bullet-resistant, and well-ventilated.
 - b. High explosives, in amounts of 125 pounds or less, should be stored in permanent magazines or in box-type magazines.
 - c. Black powder (pellet or granular), in amounts exceeding 125 pounds, should be stored in permanent magazines which are theft-resistant, fire-resistant, and weather-resistant. Metal magazines should be lined with a nonsparking material.
 - d. Black powder, in amounts of 125 pounds or less, should be stored in permanent magazines or in box-type magazines.
 - e. Detonators, in numbers of more than 5,000, should be stored in permanent magazines which are theft-resistant, fire-resistant, and weather-resistant. Metal magazines should be lined with a non-sparking material.
 - f. Detonators, in numbers of 5,000 or less, should be stored in permanent magazines or in box-type magazines.
 - g. Magazine floors should be constructed of nonsparking materials, preferably of wood, with no exposed metal.
 - h. Magazines should be securely locked when unattended.
-
- 4.03. a. The location of permanent explosives-storage magazines should conform to the amended American Table of Distances, insofar as feasible. Where the magazine location does not conform to these requirements and relocation is not practicable, effective barricades should be constructed as conditions permit.
 - b. Permanent explosives-storage magazines should not be closer than 200 feet from any vital structure, or from any mine shaft, tunnel, or slope opening to the surface.
 - c. Permanent magazines should be located a safe distance from waste dumps and on suitably drained sites.
 - d. Permanent detonator-storage magazines should be not less than 100 feet, not barricaded, or 50 feet, barricaded, from a permanent explosives-storage magazine.

- 4.04. The area surrounding a magazine for not less than 25 feet, preferably 50 feet; in all directions should be kept free of rubbish, dry grass, or other material of a combustible nature; preferably, this area should be covered with some material to prevent the growth of grass, brush, and weeds.
- 4.05. The premises on which a permanent magazine is located should be marked conspicuously by signs containing the words "EXPLOSIVES - KEEP OFF." Such signs should adequately warn any person approaching the magazine of the presence of explosives, but the signs should not be so placed as to direct general public attention to the location of the magazine. No signs should be placed on surface magazines or barricades or be so located that a bullet passing directly through the face of the sign will strike the magazine. Box-type magazines and operation storage boxes should be clearly marked with the word "Explosives."
- 4.06. When a magazine is illuminated electrically, the lamps should be of the explosion-proof type, installed and wired in accordance with the National Electric Code. The switch should be outside the building, and wiring should be in conduit.
- 4.07. Detonators, tools, or materials other than explosives should not be kept in an explosives-storage magazine, except that safety and detonating fuse may be stored in any explosives or detonator magazine. If not so stored, fuse should be kept in locked containers, locked rooms, or otherwise adequately protected against theft.
- 4.08. Unauthorized persons should not be permitted in any magazine.
- 4.09. Only hardwood or nonmetallic tools should be used for opening wooden containers of explosives or detonators. In opening cardboard containers of explosives with a knife or other cutting tool, care should be taken to avoid cutting the cartridges.
- 4.10. Waste paper, empty containers, or other combustible material should not be allowed to accumulate in explosives or detonator magazines.
- 4.11. Smoking, carrying smokers' articles, or open flame should not be allowed in or near any magazine, or while explosives or detonators are being handled.
- 4.12. Containers of explosives or detonators should always be lifted and set down carefully, never slid over one another or dropped from one level to another.
- 4.13. New explosives should be piled in a magazine in such a manner that the explosives previously stored will be used first, thus preventing possible deterioration.

- 4.14. Deteriorated or damaged explosives should be destroyed. Explosives and detonators should be destroyed only by a person who is experienced in this work, preferably a technical representative of a manufacturer of explosives.

Transportation of Explosives and Detonators

- 4.15. Vehicles used in the transportation of explosives or detonators should be constructed substantially and maintained in good working order. Any exposed metal on the inside of the body that might come in contact with any package of explosives or detonators should be covered or protected with wood or other nonmetallic material. Explosives in open vehicles should be covered with tarpaulins.
- 4.16. State or other regulations as to marking vehicles transporting explosives should be followed. If no laws or regulations are in effect, any such vehicle should be placarded on the front, each side, and the rear with the word "EXPLOSIVES" in letters not less than 3 inches high or should display a red flag with the word "DANGER" in white letters not less than 6 inches high.
- 4.17. Preferably, explosives and detonators or blasting caps should not be transported in the same vehicle. If they are transported in the same vehicle, they should be separated by at least a 4-inch substantially fastened wood partition or the equivalent. Other materials should not be hauled in the same load with detonators or explosives.
- 4.18. Explosives should not be transported in any form of pole-type trailer, nor should any such trailer be attached to a vehicle hauling explosives.
- 4.19. a. Unauthorized persons should not be permitted to ride on vehicles transporting explosives, and the driver and helper should neither smoke nor carry matches or lighters.
b. All explosives should be transported in the original shipping containers or in some other suitable container.
- 4.20. Vehicles transporting explosives should be brought to a full stop before crossing any railroad track or main public highway. Truck drivers should conform to all other traffic safety measures.
- 4.21. A vehicle containing explosives should never be left standing or unloaded without first stopping the motor and setting the brakes securely, and should never be taken into a garage or repair shop. Explosives cases should never be left immediately back of the exhaust, as a spark may start a fire or cause an explosion.
- 4.22. Explosives or detonators should never be left unattended unless they are in locked magazines.

- 4.23. Loose detonators should be placed in approved insulated containers and carried to the place of use by the blaster or other responsible persons.
- 4.24. a. Explosives and detonators should be brought to working places in the original unopened containers or in separate insulated containers and kept there until removed for placement in drill holes.
b. Capped fuse should be carried in covered, insulated containers separate from those containing explosives.

Pit Storage

- 4.25. Operation storage boxes should be used to store explosives and detonators in the pit. Not more than a 36-hour supply of explosives and detonators, including any surplus remaining from the previous day, should be stored in these boxes. To avoid deterioration of explosives, older explosives should be used first.
- 4.26. If pit operation boxes or magazines are provided, they should be:
a. Located not less than 200 feet from the actual blasting or from any operating unit, and at least 25 feet from tracks, roadways, travelways, or power cables.
b. Kept locked at all times, except when in use.
- 4.27. When operation boxes or magazines are used, the explosives and detonators should be kept preferably in separate boxes or magazines. If kept in the same box, they should be separated by at least a 4-inch substantially fastened hardwood partition, or the equivalent.

Blasting Practices

- 4.28. Shots should be charged and fired by certified or authorized persons.
- 4.29. All holes for blasting should be proved before the explosives are inserted therein. Small boreholes may be tried with an ordinary tamping stick; well-drill holes may be proved with a "dolly" or tamping block. A mirror or flashlight may be used for visual inspection.
- 4.30. Each borehole should be cleaned properly before the charge is placed in the hole.
- 4.31. Water standing in well-drill holes should be bailed out, if possible, and the holes should be loaded with an explosive of adequate water resistance. In wet holes, the detonators should be waterproofed.
- 4.32. Explosives which are so hard that a punch cannot be inserted for priming, or which are believed to be substandard in any other respect, should not be used.

- 4.33. Only low-freezing or non-freezing explosives should be used where subzero temperatures prevail. If explosives are believed to be frozen, no attempt should be made to use them or thaw them, but rather the manufacturer should be consulted.
- 4.34. Detonators and electric detonators should be kept separate and apart from other explosives until ready to be used.
- 4.35. It is recommended that primers be made up just before placing in a hole.
- 4.36. a. Primers should be made in accordance with the data published by the makers of explosives.
b. Great care should be taken to insure that detonators are securely fastened in the primer cartridge.
c. The long axis of the detonator should lie as nearly as possible in line with or parallel to the long axis of the primer cartridge, and the detonator preferably should point toward the bulk of the charge of explosives.
- 4.37. All drill holes should be stemmed to assure maximum efficiency from explosives. Stemming material should be free from coarse pieces.
- 4.38. A blast should not be fired until all surplus explosives and detonators have been removed from the immediate vicinity, preferably returned to the magazine or operation box.

NOTE: Safety fuse is manufactured by several companies and is obtainable in two standard rates of burning. The manufacturers of safety fuse make no warranty or representations as to the burning speed of their product, owing to the many circumstances and conditions to which the fuse is subjected after leaving the factory, including differences in altitude, weather conditions, storage, and character of tamping and mishandling, all of which may affect the burning speed of the fuse. However, every care and precaution are used in the manufacture of safety fuse to have it burn at a standard rate of 1 foot in either 30 seconds or 40 seconds with an allowable variation of 10 percent either way from standard when burned in the open at sea level.

- 4.39. When secondary blasting is practiced:

- a. Block holes should be used whenever practicable. The hole should be drilled deep enough to accommodate the charge of explosives as well as sufficient stemming to confine the charge.
- b. "Mudcap" or "adobe" charges should be completely covered with stemming material. Two or more charges should not be used on the same boulder unless the charges are detonated electrically or with detonating fuse.

- 4.40. The minimum length of fuse to be used in secondary blasting should be as required by State law or as established by the management, but should not be less than 30 inches.
- 4.41. a. Blasters or shot firers should always use sufficient fuse, along with an adequate warning signal or system to permit them to reach a safe place before the first hole fires.
 b. Blasters or shot firers should know the burning rate of the fuse that is being used. Tests to determine the burning rate of fuse should be made weekly and the results posted.
- 4.42. a. An effective type of lighter should be used in lighting fuse. Several types of good lighters are on the market.
 b. The use of cigarettes, burning paper, improvised torches, or matches for lighting fuse should be prohibited.
- 4.43. The allowable number of block-hole fuses to be lighted by a blaster at one time should be determined by the management. Normally, not over 12 fuses should be lighted by each blaster.
- 4.44. When preparing fuse for capping, the end to be inserted in the detonator should be cut squarely across with a clean, sharp blade or cutter and seated lightly against the charge. The detonator should be crimped tightly, using only a hand or bench-type crimper.
- 4.45. a. Electric detonators should be tested individually with a blasting galvanometer before being used. The circuit should be tested with a blasting galvanometer before the shot is fired.
 b. The leg wires of electric detonators should be short-circuited after testing and should remain so until they are connected into the circuit.
 c. Electric detonators used in well-drill holes, or long small boreholes should be tested several times during the loading of the hole and should be short-circuited again after each test. Two electric blasting caps frequently are placed in each well-drill hole.
 d. No means other than a blasting galvanometer containing a silver chloride cell manufactured for the purpose should be used for testing electric detonators or blasting circuits.
- 4.46. a. When firing electrically, the insulation on all firing lines and leading lines should be adequate and in good condition. The firing lines and leading lines should be adequate in length to assure the safety of the shot firer.
 b. When firing electrically, all firing lines and leading lines should be short-circuited at the power source end until ready to blast. The lines should be staggered as to length at the detonator end.
 c. Stranded wires should not be used in a blasting circuit.
 d. Duplex leading wire should not be used except for firing single electric detonators.

- e. Firing lines and leading lines should be kept away from track, pipe lines, power wires, and other sources of active or stray currents.
- 4.47. a. When firing from a power circuit, fuses of adequate capacity should be installed in the power line near the master firing switch.
- b. A power circuit used for firing should not be grounded.
- c. When firing electrically, a 2-conductor circuit should be used throughout.
- d. When firing from a power circuit, a master switch should always be used. It should be locked in "Open" position at all times, except when firing. Keys to the master switch should be entrusted only to the person designated to fire the shot.
- e. When firing from a power circuit, one or more safety switches should be placed in the permanent firing line in addition to the master switch used for firing. There should also be a gap at least 5 feet long in both wires of the firing lines, or between the firing lines and the leading lines; this gap should be near the master switch or at some other safe location. All switches should be short-circuited in the "off" position but not grounded.
- f. All blasts detonated with electric detonators should be fired from a source of current of ample capacity.
- 4.48. a. When firing with a blasting machine, the machine and the detachable handle or key should be kept, during the connecting of the blast and until the blast has been fired, in the possession of the person designated to fire.
- b. When firing with a blasting machine or battery, the leading wires should not be connected until immediately before firing, and should be disconnected immediately thereafter. The number of detonators connected in series should not be in excess of the rated capacity of the blasting machine.
- c. The blasting machine should be kept in good condition and tested at regular intervals. The use of a rheostat for testing purposes is recommended.
- 4.49. a. Drill holes which have been sprung or chambered, and which are not water-filled, should be allowed to cool as long as practical before explosives are loaded. The time required for cooling varies with the quantity and kind of explosives used in springing, and also with the type of rock. With small charges of explosives, at least 1 to 2 hours cooling time should be allowed; and with large charges, usually 4 or 5 hours are required. Explosives manufacturers generally recommend quick-acting ammonia dynamites, preferably gelatinous types, for springing holes.
- b. The use of "short fuses" should be prohibited when springing holes.

- c. A borehole should never be sprung when it is adjacent to or near a hole that is loaded. This is of especial importance in ground that is fissured, broken, or wet.
- 4.50. While explosives are being loaded in drill holes, all persons not necessary in connection with the blasting operations should be barred from the vicinity.
- 4.51. Detonators or other explosive material that is not to be used in the blast should not be allowed in the vicinity of the loading area.
- 4.52.
 - a. Large dynamite cartridges may be dropped in smooth well-drill holes but should not be dropped unless the hole is free from obstructions throughout its entire length.
 - b. Large dynamite cartridges should not be dropped in well-drill holes containing excessive water until the charge is above the water level.
 - c. Large dynamite cartridges that have wedged in a well-drill hole should not be tamped with a "dolly", but rather, after pouring water into the hole, attempts to dislodge or pierce the cartridges should be made with a spear-shaped wooden tamping block or a small-diameter wooden pole such as recommended by the explosives manufacturers.
 - d. Rough or ragged holes and holes closed partly by an obstruction that cannot be removed readily should be loaded with cartridge dynamite lowered with a rope, with free-running dynamite, or with dynamite cut in small pieces.
 - e. When more than one crew is loading a long line of holes, the crews should be separated by the greatest practical distance, which can be maintained as the loading operations progress and which is consistent with efficient operation and supervision of the crews. Every effort should be made to keep the loading crews a minimum of 25 feet apart and to prevent the simultaneous loading of adjacent holes.
 - f. When drill holes are to be loaded for blasting, the explosives containers should be stacked in piles at least 25 feet, and preferably farther, from the nearest drill hole to be loaded. For a given total amount of explosives in the loading area it is preferable to have a few piles each containing relatively large quantities of explosives rather than to have a large number of piles each containing a small quantity. The containers should be opened at the piles as needed and the opened explosives cases carried one at a time to the loading station. This station should be at least 6 feet from the hole to be loaded, or from any unstunned loaded hole, and at least 25 feet from the main pile. The amount of explosives at this point should not exceed 100 pounds. From this station the explosives should be passed one cartridge or unit at a time for loading into the hole. Empty cases and lining paper should be removed immediately to a waste pile.
 - g. Excessively large amounts of explosives should not be delivered to the loading area at one time. If deliveries of explosives are made by truck, the quantity permitted at or near the loading operations should be limited to one truck load. Other

- trucks loaded with explosives should wait or be unloaded in separate safe places away from the loading operations.
- h. When explosives for a blast cannot be delivered to the loading area by truck or railroad and must be carried to the holes by men, the same care should be taken to avoid having excessively large amounts of explosives in one area.
 - i. Explosives should be delivered first to the holes farthest from the truck to avoid driving or walking among piles of explosives.
 - j. Explosives in excess of immediate requirement, when removed from the main storage magazine and delivered in the vicinity of a blasting operation, should be stored in a portable magazine, or in a small building if protected by a guard, until the explosives are used, or should be stored in other suitable places properly protected against theft.
 - k. Enough suitable stemming material should be placed by each hole before the delivery of explosives to the holes is started.
 - l. Stemming should be placed in each hole as soon as practicable after the loading of the explosives has been completed, being careful to protect the detonating fuse or leg wires of electric detonators from damage.
- 4.53. Black powder should not be loaded into holes when there is any danger from sparks, flame, or other sources of ignition. All equipment that emits sparks should be removed or closed down during loading operations.
- 4.54. a. Explosives in well-drill holes may be tamped with a "dolly" when tamping is required, but the use of a "dolly" should be kept at a minimum. Extreme care should be taken not to damage the detonating fuse or leg wires of electric detonators when tamping with a "dolly."
- b. High explosives in small boreholes should be tamped with only sufficient force to collapse the cartridges. Excess ramming should be avoided. The primer cartridge should never be tamped.
- 4.55. Tamping sticks, "dollies", or blocks should be made of wood with no exposed metal parts. Jointed wooden tamping sticks with exposed couplings made of nonsparking material may be used.
- 4.56. Only holes which are to be blasted immediately should be loaded.
- 4.57. When priming well-drill holes with detonating fuse, it should be lowered to the bottom of the hole either by attaching it to the first cartridge or by other means. It should then be cut from the reel and the reel moved well away or to the next hole before any other explosives are loaded. The detonating fuse should extend from the hole a distance of 2 or 3 feet to compensate for any subsidence, should be drawn taut and made secure on the top where it will not interfere with loading operations or come in contact with explosives on the ground. It should be checked each time before stemming material is used to see that it has not been broken.

- 4.58. a. When detonating fuse is used, main or trunk line splices should be factory splices or tight square knots. No splices should be used in the drill hole.
- b. All branch-line connections and all connections in the main line other than splices should be tight and at right angles.
- c. Main or trunk lines should be laid out free of kinks or coils and all connections should be inspected before firing the blast.
- 4.59. When connecting a detonator or an electric detonator to detonating fuse, a connector for the purpose should be used, or it should be taped or otherwise attached securely alongside and at the end of the detonating fuse with the end of the detonator containing the explosive charge pointed in the direction in which the detonation is to proceed. Detonators should not be brought to the loading area nor attached to the detonating fuse until all is in readiness to fire the blast.
- 4.60. Plain detonating fuse may be used for trunk lines or in shallow drill holes, but reinforced or wire-protected types should be used in deep or ragged holes.
- 4.61. Warning signals should be given, and all workmen required to retreat to a safe place, before the shots are fired.
- 4.62. Guards should be posted on the surface when overburden is being blasted, to prevent anyone from approaching the vicinity of the blasts.
- 4.63. After firing multiple shots, a careful examination should be made for misfires by an authorized person before workmen are permitted to return to the vicinity.
- 4.64. a. Each misfire presents an individual problem and should be handled under the personal supervision of the blasting foreman or pit foreman. Extreme care should be used in handling misfired holes.
- b. In the case of a misfired hole, remove the stemming to within approximately 12 inches of the explosives, when possible, using a jet of water or compressed air when water is not available. Place a primer in the hole and fire as usual. This will generally detonate the unexploded charge. For further suggestions in the handling of misfired holes, refer to pamphlet entitled "Safety in the Handling and Use of Explosives," published by the Institute of Makers of Explosives, 103 Park Avenue, New York, New York.
- 4.65. Special precautions should be taken when blasting in strip mines that are adjacent to underground workings. Where such conditions exist, blasting should be done only when all men have been removed from the underground workings. The underground workers should not

be allowed to reenter the underground mine after the blasting operations in the strip mine until a thorough search for carbon monoxide and other toxic gases is made in the underground mine, and any dangerous gases are removed.

- 4.66. Explosives should not be transported, handled, or used immediately before or during an electrical storm.
- 4.67. An accurate daily record should be kept of:
 - a. The amount of explosives and detonators issued, used, and returned.
 - b. The number of shots fired and misfired.

Liquid-Oxygen Explosives

The following recommendations apply to the use of liquid-oxygen explosives:

- 4.68. All persons authorized to handle and use liquid-oxygen explosives should be instructed in their properties and characteristics so that they may better comprehend the necessity for safe handling and use of this explosive.
- 4.69. Liquid-oxygen plants should be in isolated locations away from other buildings, railroad tracks, or highways and should be protected from unauthorized visitors by a tight fence on which warning signs should be posted. The fence gate should be kept locked at all time unless authorized persons are present.
- 4.70. Smoking should be absolutely prohibited in or near the building where liquid oxygen is manufactured or the soaking of cartridges is done. Men should be searched for smokers' articles before being permitted to enter a building where liquid oxygen is manufactured, or cartridges are soaked.
- 4.71. Precautions should be taken to prevent the ingredients, such as the carbonaceous absorbent, liquid oxygen, the containers, or the finished cartridges, from being contaminated with rusty pieces of metal, oil, grease, paint, or other foreign materials that may increase the sensitivity of the explosive.
- 4.72. The cartridge bag should be strong enough to prevent breakage when the cartridge is charged into the hole, and woven closely enough to prevent the absorbent from sifting out during handling.
- 4.73. The end of the cartridge bag should be closed securely to prevent spillage of the contents in handling and charging.
- 4.74. The diameter of the finished cartridge should be checked to prevent oversize cartridges which might lodge in the borehole.

- 4.75. Cartridges should be soaked in a room separated from the main part of the plant and should preferably be in a closed, fire-resistant building.
- 4.76. The absorbent should be one that will give an explosive with a minimum of sensitivity, and tests should be made of each shipment of absorbent to insure the uniformity and purity of the product.
- 4.77. Soaking boxes should be inspected frequently and kept in good condition. They should be kept clean and free of loose absorbent or other sediment.
- 4.78. Explosion-proof lights should be provided in the soaking room.
- 4.79. The cartridges should not be touched or handled with any implement unless such implements are made entirely of wood, plastics, or other nonsparking or nonconductive material.
- 4.80. It is recommended that liquid-oxygen explosives be fired with detonating fuse, because of the safety features of this fuse and its efficiency at low temperature.
- 4.81. If electric detonators are used, they should not be placed in the priming cartridge until immediately before placing the primer in the hole, and the primer should be the last to be inserted in the hole. Only detonators suitable for liquid oxygen explosives should be used.
- 4.82. The holes should be charged deliberately and systematically. Even with liquid-oxygen explosives, speed should not be emphasized unduly. The cartridges should not be dropped or forced into a borehole; they should be lowered slowly by means of a rope.
- 4.83. Lodged, hung, or misfired cartridges should be left untouched until the oxygen has evaporated.
- 4.84. The practice of soaking cartridges during transportation should be prohibited if it is possible to do otherwise.

5. HAULAGE

Surface Haulage - Railroads

- 5.01. Track and roadbed should be maintained in good condition.
- 5.02. There should be an unobstructed space of 24 inches from the widest part of railroad cars or locomotives to the nearest obstruction on both sides of each railroad track. Where clearance is less than 24 inches, a warning sign calling attention to this condition should be posted.

- 5.03. Switch throws should be so installed as to provide adequate clearance for switchmen.
- 5.04. Derail devices should be installed where necessary on all sidetracks near junctions with main lines and at other places where needed.
- 5.05. In handling railroad cars, a brakeman should:
- Use a suitable brake stick.
 - Wear a protective hat.
 - Use a railroad-type pinch bar for shifting cars.
 - Wear snug-fitting clothing.

Surface Crossings

- 5.06. Where surface operations require that many persons pass over the haulageway, a warning signal should be installed or an overhead walkway or underpass provided.
- 5.07. All railroad and mine-surface track crossings should be provided with warning signs.
- 5.08. Grade crossings should be eliminated as far as practicable. The crossings should be planked or filled between the rails; they should have "Stop" signs on each side of the track; and the track should be visible in both directions from the crossing as far as it is possible to arrange.
- 5.09. Hazardous crossings should be guarded while cars are being moved.

Surface Inclines

- 5.10. Inclines should have:
- A positive stopblock at the top.
 - A derail near the top.
 - A derail near the bottom.
- Pit Haulage - Railroad Equipment and Operation
- 5.11. Rails should be heavy enough to carry safely the heaviest rolling stock and should be firmly attached to ties of adequate size and spacing.
- 5.12. Roadbeds should be kept well drained and surfaced.
- 5.13. Haulage roads should be kept free of coal spillage and debris.
- 5.14. a. The permanent track should be alined properly and free from high or low joints, broken rails, defective switches, defective frogs, and improperly alined frogs.
- b. Temporary tracks should be well-blocked and sufficiently well-ballasted to hold.

- 5.15. On all haulage roads, rail joints should be connected with plates and rails well-supported by ties.
- 5.16. Track switches should be provided, complete with throws and bridle bars.
- 5.17. Frogs and guard and lead rails should be blocked if there is danger of persons catching their feet in them.
- 5.18.
 - a. Haulage equipment should be inspected daily and maintained in safe condition.
 - b. All locomotive boilers and their appurtenances should be thoroughly inspected semiannually, internally and externally, and under operating conditions, by a competent inspector; they should not be operated at steam pressures in excess of the safe working pressure stated in the certificate of inspection.
- 5.19. All locomotives should be equipped at both ends with firmly fastened grab irons and stepboards maintained in good condition.
- 5.20. Locomotives should be equipped with a gong or other warning device. They should be handled carefully and kept under control at all times. Locomotives should be equipped with effective headlights for night operations.
- 5.21. All locomotives should be equipped with rerailers, track tools and supplies, and track jacks at all times, unless such equipment can be quickly and easily secured from a central supply point.
- 5.22. Only authorized persons should operate locomotives.
- 5.23. Riding on locomotives should be prohibited except to those operating the trip and persons authorized by the management.
- 5.24. Riding on top of loaded cars, between ears, or on bumpers in front of ears should be prohibited.
- 5.25. Locomotive engineers should sound a warning signal when approaching stripping equipment, and should not attempt to pass a shovel or dragline until the all-clear signal is given by the shovel or dragline operator.
- 5.26. Brakemen should not get on or off ears or trips in motion.
- 5.27. Cars that are not coupled to locomotives should be blocked securely while being loaded. If cars have brakes, they should be set also.
- 5.28. Cars should not be coupled or uncoupled by hand while they are in motion unless a coupling hook or other equally effective device is used. Flying switches should be prohibited.

- 5.29. Rocker- or cradle-type dump cars should be equipped with an efficient locking device.
- 5.30. "Poling" or moving a car on another track with a pole should be done only in an emergency. The pole should be placed against the car to be pushed and the engine brought to the other end of the pole and the bumper held tightly against the pole. The car should not be pushed until all persons are in safe places.
- 5.31. a. Cars should not be left on side tracks unless ample clearance is left for the main-line transportation.
 b. Cars left on an incline should be well blocked and have the hand brake set tight. If the track leads into a place where men are working, a derailer or derail switch should be provided.
- 5.32. Workmen required to do repair work under equipment such as locomotives and cars should be protected by a portable derailer or suitable warning signal to prevent trainmen from making a coupling.

- 5.33. Cars of materials or supplies being loaded or unloaded should have warning signs placed at both ends of the car or train to prevent trainmen from making a coupling.

Pit Haulage - Automotive Equipment and Operation

- 5.34. Trucks should be inspected daily and maintained in safe condition.
- 5.35. Trucks should be "warmed up" in the open and never in the garage.
- 5.36. The motor should be shut off before the driver leaves the cab for any reason whatsoever, and also before refueling. Before leaving the cab, the driver should always set the brakes and leave the truck in gear.
- 5.37. Trucks should be handled carefully and kept under control at all times. They should be provided with efficient headlights and warning devices.
- 5.38. Only authorized persons should operate trucks.
- 5.39. a. Riding on trucks should be prohibited except to the operator and persons authorized by management.
 b. All persons should be prohibited from riding on the running boards of any truck.
- 5.40. Standard traffic rules and signals should be adopted and should be strictly followed.
- 5.41. Truck drivers should sound a warning signal when approaching the stripping equipment and should not attempt to pass a shovel or dragline until they receive the return signal from the shovel or dragline operator. Where pit conditions prevent an exchange of signals between truck drivers and shovel or dragline operators, a flagman should be on duty to give signals.

- 5.42. Truck roads should be maintained in good condition.
- 5.43. Berm width should be sufficient to provide adequate clearance for the safe passing of trucks.
- 5.44. During dry weather, main haulage roads should be kept sprinkled or other methods of allaying dust should be used. During icy or slippery weather, sand, fine cinders, or coal should be used on ramps, driveways, etc.
- 5.45. When trucks are traveling in the same direction, drivers should maintain safe distances between trucks.
- 5.46. Truck roads leading from the pit to the surface should be arranged to provide one-way traffic, particularly if the road is on a steep grade. If this is not practicable, the road should be wide enough to accommodate free passage of trucks at all points, or definite turn-outs and waiting points should be designated.
- 5.47. a. All persons should be prohibited from working on the chassis of a truck with the body in a raised position until after the truck body has been securely blocked in position. The mechanical hoist mechanism should not be depended upon to hold the truck body in a raised position.
b. A tire should be deflated before the casing is removed from the rim.
- 5.48. A substantial bumping block to stop a truck backing, or a safety hook designed to engage the front axle, should be provided at all places where a rear-dump truck discharges its load, unless the load is being dumped for spreading.

6. ELECTRICITY

Surface Transmission Lines

- 6.01. Overhead high-potential power lines should be placed at least 15 feet above the ground and 20 feet above driveways and should be supported and guarded adequately to prevent contact with other circuits.
- 6.02. Poles should be planted firmly in the ground and should be well-guyed at turns and dead ends.
- 6.03. Guy wires from poles supporting high-potential transmission lines should be grounded unless equipped with insulators. If insulators are used, they should be installed near the poles.
- 6.04. Insulators should be adequate in quality and design for the voltage transmitted. At dead ends, or at points where abrupt turns are made in the transmission lines, strain insulators should be used.

- 6.05. The surface electric equipment and overhead power circuits should be protected adequately against lightning or voltage surge.
- 6.06. High-potential power lines should be protected adequately by circuit breakers.

Surface Transformer Stations

- 6.07. Unless transformers are isolated by elevation (8 feet or more above the ground), they should be surrounded by a suitable enclosure. If the enclosure is of metal it should be effectively grounded.
- 6.08. The gate or door to the transformer enclosure should be kept locked at all times unless authorized persons are present.
- 6.09. If surface transformers containing flammable oil are installed where they present a fire hazard (in or near combustible buildings), means should be provided to drain or confine the oil in event of rupture of the transformer casing.
- 6.10. Casings of all transformers should be grounded unless protected by isolation (freedom from contact by position).
- 6.11. "Danger - High Voltage" signs should be placed on all transformer enclosures, high-potential switchboards, and other high-potential installations.

Substations

- 6.12. Switchboards should:
 - a. Have ample working space around and back of them, free of rubbish and stored material.
 - b. Have entrance at each end to permit authorized persons to inspect, adjust, or repair apparatus back of switchboard.
 - c. Be adequately lighted.
 - d. Have control readily accessible for emergency shut-down.
 - e. Have a disconnecting switch on incoming power circuits.
 - f. Have entrance to rear guarded against unauthorized entrance.

General (Surface Electricity)

- 6.13. Rheostats and electric heaters should be so installed as to prevent fire, electric shock, or burn-injury hazards.
- 6.14. Switches and circuit breakers should be so installed that they are readily accessible and can be operated without danger of contact with moving or live parts.
- 6.15. Electric wiring in all surface buildings should be so installed as to present minimum fire and contact hazards.

- 6.16. All electric appliances, machines, and conductors should be large enough for the required work.
- 6.17. All metallic coverings and armor of cables and conduit should be grounded, and should be electrically continuous to afford a conductor path for the ground circuit.
- 6.18. All metallic frames, casings, and coverings of motors, generators, switchboards, and other electric equipment that can become "alive" through failure of insulation or by contact with energized parts should be grounded.
- 6.19. Ground connections should be tested frequently to determine their continuity and occasionally to determine their resistance.
- 6.20. The metal frames of drills and other electric tools intended to be held in the hands while being operated should be grounded effectively.
- 6.21. Dry wooden platforms, rubber mats, or other electrically non-conductive material should be kept in place at all switchboards and stationary machinery where shock hazards exist.
- 6.22. Wires or other conducting materials should not be used as a substitute for properly designed fuses.
- 6.23. Electric equipment should be protected against excessive overload by fuses or equivalent protective devices of the correct type and capacity.
- 6.24. Fire extinguishers approved for electrical fires should be provided at all electric installations. If such extinguishers cannot be obtained, rock dust should be available.
- 6.25. Trolley wires should be:
 - a. Kept taut and securely supported by enough insulated hangers to prevent sag.
 - b. Adequately guarded where men are required to pass under the wire, unless the wire is $6\frac{1}{2}$ feet or more above the top of the rail.
- 6.26. If track is used for the return circuit, both rails should be bonded at every joint and cross-bonded at least every 200 feet.

Pit Electrical Installations and Equipment

- 6.27. All electric equipment should be provided with switches of safe design, construction, and installation.
- 6.28. A suitable cut-out switch should be installed at all branch circuits adjacent to main lines.

- 6.29. Cut-out switches should be marked so that they may be found readily in case of emergency.
- 6.30. Circuit breakers should be provided to protect all power circuits. If they are automatic, they should be set so that the circuits cannot be overloaded; if they are hand-set, the handles should not be tied in place.
- 6.31. Trailing cables should be properly protected against mechanical injury at all places where trucks and other vehicles are required to cross.
- 6.32. Cables should be of ample thermal capacity and mechanical strength for the service intended. Preferably, the individual conductors of trailing cables carrying above 600 volts should be shielded.
- 6.33. Cables should be examined regularly and any defects found in the cable should be repaired immediately.
- 6.34. Cable splices should be made in a workmanlike manner, mechanically strong, and well-insulated. Preferably, when a cable is defective, a stand-by cable should be used and the defective cable sent to the shop for permanent splicing and vulcanizing.
- 6.35. Portable transformers should be enclosed in a transformer house or by a substantial fence at least 6 feet high. The opening to the enclosure should be locked when the transformers are located near a public road, or if they are not under constant surveillance of authorized employees.
- 6.36. The casings of all transformers and the frames of all equipment should be grounded.
- 6.37. High-potential transmission lines should be grounded while repair work is being done on the lines.
- 6.38. In all alternating-current power systems where the line-to-ground voltage exceeds 150 volts, it is recommended that the system be grounded through a suitable impedance at the transformer bank and a suitable neutral or ground conductor connected between the impedance and the electric equipment. A relay should be provided to trip the circuit upon the occurrence of an electrical fault. In connection with large strip mines where more than one stripping shovel is in operation, it may be desirable to provide overcurrent relays at each unit.
- 6.39. Power should be disconnected when repair work is being done on electric equipment, and accessories such as trailing cable, transmission lines, switches, junction boxes, and the like.
- 6.40. All cables carrying in excess of 440 volts should be handled with suitable insulating hooks when the power is on. Cables carrying 440 volts or less should be handled with rubber gloves or insulating hooks.

- 6.41. Electric equipment should be inspected daily and maintained in safe condition. Repairs should be made only by authorized persons.

7. ADDITIONAL SAFEGUARDS FOR MECHANICAL EQUIPMENT

Shop Equipment

- 7.01. Machinery and belting exposed to possible personal contact should be guarded adequately, as indicated below:
- Gears, sprockets, friction devices, and couplings with protruding bolts or nuts should be completely guarded.
 - Shafting and projecting shaft ends within 6 feet of the floor or platform level should be completely guarded.
 - Vertical or inclined belt, chain, or rope drives should be suitably guarded to a height of at least 7 feet from the floor.
 - Horizontal belt, chain, or rope drives within 7 feet of floor or platform should be guarded.
 - Flywheels should be guarded. Where flywheels extend more than 6 feet above the floor, they should be guarded to a height of at least 6 feet.
 - Circular and band saws and planers should be adequately guarded.
 - Locomotive pits should be guarded, and guards kept in place when the pit is not in use.
 - When guards are removed for oiling or repairs they should be replaced promptly.
- 7.02. Shop machinery should be adequately illuminated.
- 7.03. Adequate clearance should be provided at machine installations, and passageways should be kept free of stumbling hazards.
- 7.04. Machinery should not be repaired or oiled while in motion, unless such oiling can be done without danger to the oiler.
- 7.05. A guard or safety device removed from any machine should be replaced before the machine is put in operation.
- 7.06. Mechanically operated grinding wheels should be equipped with:
- Safety washers.
 - Substantial retaining hoods, the throat openings of which do not expose more than a 90° sector of any wheel. Preferably, not more than a 60° sector should be exposed.
- 7.07. If grinding operations are frequent or constant, a dust-collecting system should be installed to remove liberated dust, or a permissible respirator should be worn by the operator.
- 7.08. Stationary welding locations should be well ventilated and shielded.

- 7.09. Welding equipment should be maintained in a safe condition. Tanks should be handled in a careful manner.
- 7.10. Gas welding equipment should be used in conformity with the manufacturer's safety rules furnished with such equipment.
- 7.11. Ropes, chains, and slings should be adequate in size to handle the load with a proper factor of safety.
- 7.12. Ropes, chains, and slings should be examined carefully before being used. They should be replaced as soon as there is evidence of undue weakness.
- 7.13. a. Handles of hand tools should be sound, tight, and free from splinters, sharp edges, and roughness.
 b. The use of defective tools, such as mushroomed chisels and wrenches with sprung jaws, should be prohibited.
 c. Hand tools should be inspected regularly by a competent person. Defective tools should be repaired before further use.

Stripping and Loading Equipment

- 7.14. Operators of shovels, draglines, and tractors should not operate their equipment when any persons are in such proximity as to be endangered. The equipment should be provided with efficient warning devices.
- 7.15. Operators of stripping equipment should not swing the dipper or bucket over passing haulage units.
- 7.16. Operators of loading shovels should always swing the dipper over the body of the truck and never over the cab.
- 7.17. Dippers should be lowered for repairs. Men should not work under a suspended dipper, and no person should be permitted to ride in a dipper or bucket.
- 7.18. Stripping and coal-loading equipment should be inspected daily. Particular attention should be given to the condition of the cables. Hoist and counterweight ropes should be inspected daily. Boom suspension cables should be inspected at regular intervals, but not less than once a month.
- 7.19. Walkways and platforms on shovel and dragline booms should be maintained in safe condition. The walkways and platforms should be equipped with safe handrails.
- 7.20. Men should not be permitted to get on or off draglines or shovels without notifying the operator.
- 7.21. Men should not be permitted within the sector of shovels or draglines unless in the line of duty.

- 7.22. Good housekeeping should be practiced on shovels and draglines.
- 7.23. Oil and grease should be stored in closed metal containers and in such a manner as not to present a fire hazard.
- 7.24. Stripping and coal-loading equipment should be well illuminated if used on the night shift. Tractors should be equipped with efficient headlights for night shift operations.

8. MISCELLANEOUS HAZARDS

Lighting

- 8.01. Adequate illumination should be provided for men on the night shift. Preferably, electric cap lamps or flashlights should be provided for men who require portable lights.
- 8.02. Extension cord lamps with exposed metal sockets should not be used.

Protective Clothing

- 8.03. Protective hats should be worn by all persons where there is danger from falling objects.
- 8.04. Protective footwear should be worn by all persons while on duty around mines.
- 8.05. All men exposed to dust-inhalation hazards should wear permissible dust respirators.
- 8.06. Men should be required to wear safety goggles when using grinding tools and when doing other work where particles are likely to fly. Where corrective-lens goggles are needed, they should be used.
- 8.07. Welders and helpers should be provided with proper shields to protect their eyes.
- 8.08. Gloves should be worn when material is handled that may injure the hands. Rubber gloves should be worn by employees when doing work that requires them to come in contact with electric equipment involving shock hazard.
- 8.09. Haulagemen and others who work around machinery should wear snug-fitting clothing.

9. GENERAL SAFETY CONDITIONS

Safety Rules and Standards

- 9.01. Special company rules regarding mine safety should be adopted and supplied to the workmen; they should be approved by the State agency governing mining, where such approval can be obtained.

- 9.02. New employees should be fully instructed regarding the company safety rules and the particular hazards incident to their work; this applies to both experienced and inexperienced personnel.

Safety Organization

- 9.03. A safety engineer or director should be employed for mines employing 100 persons or more.
- 9.04. A safety organization of officials and employees should be established, if practicable.
- 9.05. Safety meetings of employees and officials should be held at least monthly. These meetings may consist of frequent short talks on safety given to the employees in the pit and at the surface plant.
- 9.06. A safety committee, including workmen and officials, should make periodic inspections of the mine and submit recommendations for correcting hazards observed.

Bulletin Board

- 9.07. A bulletin board should be provided and posted with suitable bulletins.

Accidents

- 9.08. Accidents involving injury to persons and serious noninjury accidents should be investigated and a record kept of such investigations.
- 9.09. A record should be kept of all accidents involving loss of time beyond the day the accident occurred; these should be summarized monthly as well as annually and studied with a view to making needed corrections in practice.
- 9.10. Responsibility for accidents should be placed, if it is feasible to ascertain such responsibility.

Supervision

- 9.11. An adequate number of foremen should be employed to supervise properly all pit and surface plant operations.

First Aid

- 9.12. All employees should be given first-aid training as soon as possible after being employed.
- 9.13. If feasible, additional first-aid training should be given to all employees annually.

- 9.14. Adequate first-aid material should be provided on the surface and in the pit and kept in clean, usable condition.
- 9.15. Instructions in artificial respiration should be posted at every electrical station, and all employees working with or around electric equipment should know how to give artificial respiration.

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